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# SAFETY OF PRECAST REINFORCED CONCRETE AND PRESTRESSED STRUCTURAL MEMBERS BY THE SECOND LIMIT STATE (SERVICEABILITY LIMIT STATE)

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Safety of Precast and Prestressed Reinforced Concrete Structural Members by the Second Limit State (Serviceability Limit State)

The paper concerns the results of the study of the safety of reinforced concrete and prestressed structural members with respect to their crack resistance and stiffness. The study of safety of stiffness and crack resistance of reinforced and prestressed concrete of these structural members was carried out by the research institutes TSNIIpromzdaniy and NIIZHB. The analysis of the strength safety is based on the results of the tests of 416 prestressed laboratory samples, 2183 prestressed and 1213 reinforced concrete commercial structural members. The stiffness and crack resistance of the structural members were estimated under a service load.

It was found that the basic source of increased safety of reinforced and prestressed structural members by crack resistance was a high safety level of the design tension strength of concrete. Recommendations were presented on the crack resistance design taking into account an increased safety of structural members with a developed tension zone by correcting the characteristics of the design tension strength of concrete.

The strength safety analysis was made comparing the USSR and USA building codes.

The review is intended for engineers of design and research institutes and construction companies.

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Table 6. Test results of concrete strength by the laboratories of USA and Great Britain. Statistical characteristics of compressive, flexural and axial tension strength.

| Characteristic of samplings of test results of compressive, flexural and axial tension strength of concrete | Volume of sampling | Statistical characteristics of concrete strength (psi) | | | | | | Coefficient of correlation between compressive and flexural strength of concrete |
|---|---|---|---|---|---|---|---|---|
| | | Compression | | | Tension | | | |
| | | Mean | Standard deviation | Coefficient of variation | Mean | Standard deviation | Coefficient of variation | |
| Cylindric compressive strength $f_c$ and modulus of rupture $f_r$ | 3650 | 4437 | 1687.5 | 0.383 | 619 | 164.9 | 0.266 | 0.831 |
| Cylindrical compressive strength $f_c$ and axial tension strength $f_t$ | 759 | 3473 | 1403.9 | 0.408 | 285 | 132.5 | 0.465 | 0.864 |
| Cylindrical compressive strength $f_c$ and splitting tension strength $f_{split}$ | 466 | 4034 | 1472 | 0.365 | 415 | 125.3 | 0.302 | 0.882 |
| Cubic compressive strength $f_{cu}$ and modulus of rupture $f_r$ | 489 | 5939 | 2550.3 | 0.429 | 623 | 211.9 | 0.34 | 0.82 |
| Cubic compressive strength $f_{cu}$ and axial tension strength $f_c$ | 210 | 5116 | 2175 | 0.425 | 402 | 140.7 | 0.349 | 0.796 |
| Cubic compressive strength $f_{cu}$ and splitting tension strenght $f_{split}$ | 371 | 4654 | 1925.9 | 0.414 | 316 | 116.9 | 0.414 | 0.908 |
| Modified cubic strength $f_{cu}^{mod}$ and modulus of rupture $f_r$ | 1107 | 4837 | 2105.6 | 0.435 | 584 | 179.8 | 0.308 | 0.865 |

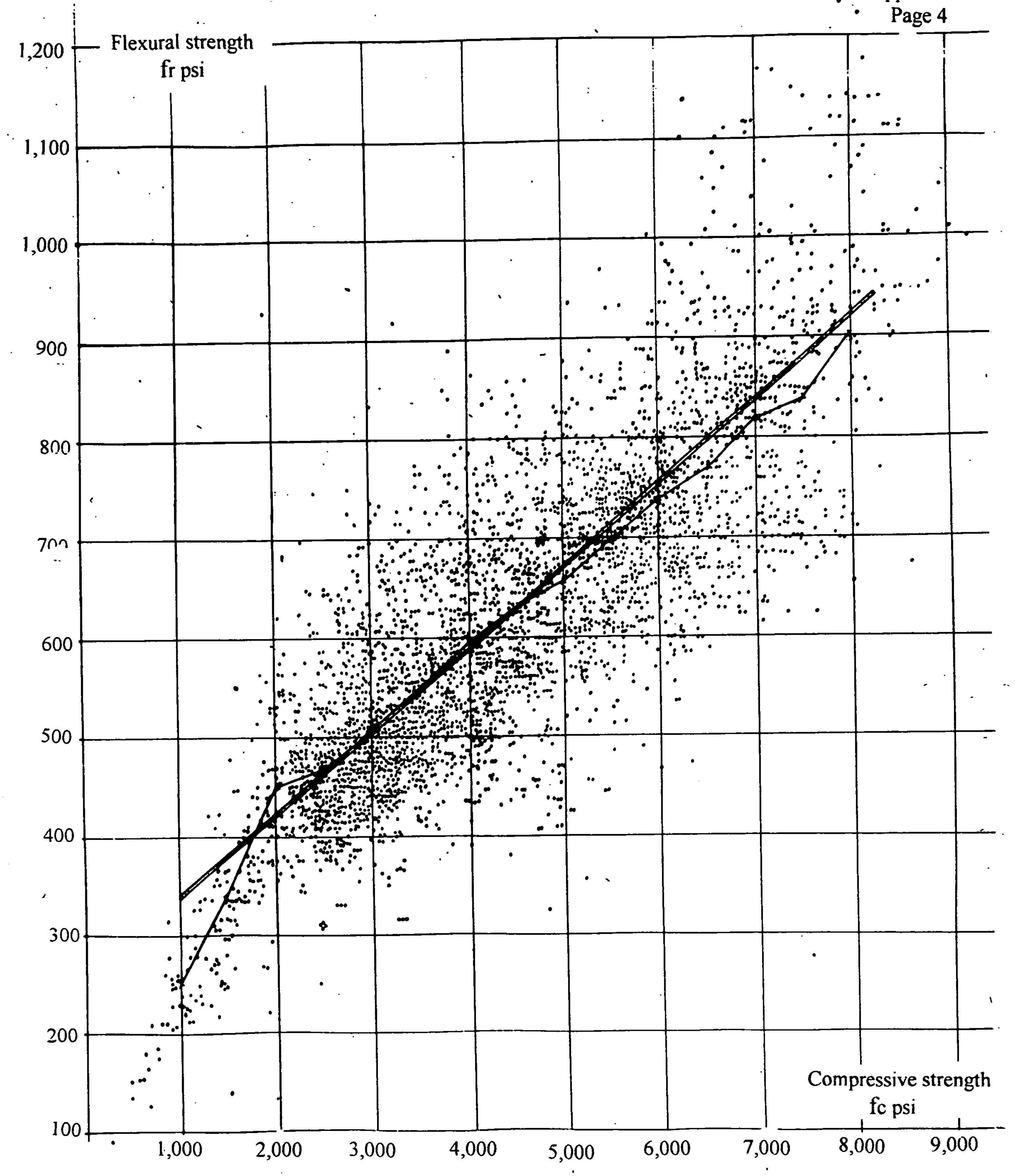


Fig.8 The change of flexural strength of concrete depending on the compressive strength of this concrete.
The empirical line of regression
The theoretical line of linear regression